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FIVE-YEAR WORK PROGRAMME OF THE INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY*

prepared by

UNIDO Secretariat

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- Selective Application of Advanced Biotechnology for Developing Countries	ID/WG.382/2/Add.1
- Application of Genetic Engineering for Energy and Fertilizer Production from Biomass	ID.WG.382/2/Add.2
- Hydrocarbon Microbiology with Special Reference to Tertiary Oil Recovery from Petroleum Wells	ID/WG.382/2/Add.3
- Application of Genetic Engineering and Biotechnology for the Production of Improved Human and Animal Vaccines with Particular Reference to Tropical Diseases	ID/WG.382/2/Add.4
- Improved Agricultural and Food Products through Genetic Engineering and Biotechnology	ID/WG.382/2/Add.5
- Bio-informatics	ID/WG.382/2/Add.6

INTRODUCTION

1. This note and its addenda present the Work Programme of the proposed International Centre for Genetic Engineering and Biotechnology (ICGEB) for the first five years of its operation. They are intended to serve as the basis for the five-year budget of the Centre and also to provide a general view of the thrust of the Centre's work. It is envisaged that a broad endorsement of the programme would result from the high-level meeting, thereby facilitating the start-up and the operation of the Centre.

2. This note deals with the general aspects of the Work Programme as a whole, while the addenda contain detailed proposals on programme elements. The programme elements and the experts primarily responsible for designing the proposals under them are:

1 Selective Application of Advanced Biotechnology for Developing Countries by Professor Carl-Göran Hedén;

2 Application of Genetic Engineering for Energy and Fertilizer Production from Biomass by Professor Ray Wu;

3 Hydrocarbon Microbiology with Special Reference to Tertiary Oil Recovery from Petroleum Wells by Professor Ananda Chakrabarty;

4 Application of Genetic Engineering and Biotechnology for the Production of Improved Human and Animal Vaccines with Particular Reference to Tropical Diseases by Professor Ahmed Bukhari and Professor Ulf Petterson;

5 Improved Agricultural and Food Products through Genetic Engineering and Biotechnology by Dr. David McConnell; and

6 Bio-informatics by Professor Carl-Göran Hedén.

Each programme element broadly consists of the following: background and justification; activities; work plan; financial requirements; and linkages with other institutions.

3. It is recognized that research and development in genetic engineering and biotechnology is in a particularly dynamic state. Therefore no work programme can be rigidly defined for a period of five years. Besides, the operation of a unique international venture like the ICGEB cannot be spelt out in all detail in advance of its establishment. The Board of Scientific Directors of the Centre 1/ should therefore have an opportunity to look at the programme again and make such elaborations and modifications as may be necessary in the light of the prevailing trends in research and development and other factors.

I. BACKGROUND

4. The idea of an International Centre for Genetic Engineering and Biotechnology was proposed by a number of eminent scientists in February 1981, in a meeting convened by the UNIDO Secretariat for an exchange of views on genetic engineering and biotechnology. 2/ Subsequently, at the request of the UNIDO Secretariat, several experts involved in the meeting participated in a series of missions 3/ to 16 developed and developing countries, during the course of which views were exchanged, inter alia, on the research and development priorities, as perceived by the countries. As a result, while recommending the establishment of the Centre, the report of the experts 4/ also suggested six subject areas to which priority attention may be given in the initial years in regard to research

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1/ See 'The Establishment of an International Centre for Genetic Engineering and Bio-technology (ICGEB), UNIDO/IS.254, page 18, and 'Draft Memorandum of Understanding and Guiding Principles of the International Centre for Genetic Engineering and Biotechnology', ID/WG.382/1.

2/ See Exchange of Views with Experts on the Implications of Advances in Genetic Engineering for Developing Countries, UNIDO/IS.259

3/ The experts who participated in one or more of the programme elements of the missions were: C.G. Hedén, H. Boyer, A. Bukhari, A.Chakrabarty, S. Narang and R. Wu.

4/ See UNIDO/IS.254

and development and pilot plant activities. 5/ The Work Programme present here is in essence an elaboration of proposals in those six areas.

5. Since the publication of the report on the establishment of the Centre, detailed discussions have been entered into with policy-makers and the scientific and technological community in a number of interested countries. Several of them were countries which have not been visited for the purpose of the preparation of the report but were later visited on their request. National-level meetings with policy-makers and the scientific and technological community were also held in some of them. These subsequent exchanges of view have also confirmed broadly the priority areas which had been identified as a result of the first round of field visits.

6. The UNIDO Secretariat requested one expert to take charge of the elaboration of a proposal in each of the six specific subject areas. Before preparing the proposals, the experts met collectively with the UNIDO Secretariat. After the proposals were prepared, the experts met again and reviewed each proposal collectively, paying particular attention to the interlinkages and complementarities among their proposals. An additional proposal on bio-informatics was added, it being considered essential as a service activity for all the others. The proposals under drugs and pharmaceuticals and human and animal vaccines have been merged in one programme element.

7. The Work Programme thus presented in the document is a product of the efforts of a group of high-level experts in this field and is based on the perceptions of the priority needs of developing countries emanating from their discussions in various countries. The UNIDO Secretariat would like to thank the experts for the dedication and high quality of expertise that they have brought to bear on this task.

5/ The six areas were: (i) tertiary oil recovery from petroleum wells; (ii) energy, and fertilizer from biomass, in particular using genetically manipulated bacteria; (iii) improvement of fermentation techniques, particularly of relevance to least developed countries; (iv) development of improved human and animal vaccines; (v) improved agricultural products using phytochrome genes; and (vi) drugs and pharmaceuticals for tropical diseases.

II. CONSIDERATIONS IN THE DESIGN OF THE WORK PROGRAMME

8. The foremost consideration in the preparation of the Work Programme has obviously been that it should accord closely with and promote the objectives of the International Centre. The objective of the Centre, as envisaged in the report on its establishment, is the strengthening of technological capabilities at the national level, particularly in the developing countries; addressing the pressing problems of developing countries, particularly in those areas where concerted R+D attention has not been given; and to bring together for this task the highest level of expertise available in the world. In the words of the expert mission "the mission envisages that the Centre will make fundamental contributions to genetic engineering and biotechnology and will directly help to develop the capabilities of scientists and technologists from the developing countries. These scientists and technologists should then be provided with the necessary means and materials to use their creativity to the benefit of their societies. The primary function of the Centre will be to stress research and development efforts through which scientists and technologists from developing countries will also be trained..... ICGEB must provide facilities that stimulate the cross fertilization between advanced knowledge on the one hand and simple needs and resources on the other and permit the expression of indigenous creativity. Many examples of cross fertilization mentioned in the course of the visits indicated that ICGEB might develop a unique interest profile that could attract scientists from many parts of the world". 6/

9. Having regard to the objectives of the Centre, the experts preparing the Work Programme have taken into account and sought to reconcile several criteria for selection of the elements of the Work Programme, such as:

6/ See UNIDO/IS.254, pages 11 and 8.

(a) the extent of general interest on the part of many countries;

(b) the magnitude of the local need and the potential global impact of the projects;

(c) the technical and scientific feasibility of the projects;

(d) the potential of the projects to trigger off R+D activities and industrial implementation;

(e) the extent to which a contribution could be made to industry as well as other areas, such as food, health, energy and environment; and

(f) the need for a critical mass of efforts for the Centre to produce useful results and to generate worldwide interest and co-operation in this field.

10. In the formulation and review of the proposals, the experts also found that a Work Programme designed to serve the above objectives should balance several considerations, such as the need for selectivity and for advance over a broad front, short-term results and long-term capacities, an effective combination of basic and applied research, and the element of transdisciplinarity which will be a unique feature of the Centre. In addition, they agreed upon the need for providing sufficient flexibility for the implementors of the Work Programme and for effective interaction with ongoing work in the disciplines involved as also the problem addressed. The experts also felt that the proposals should be designed in a modular fashion so as to facilitate implementation.

11. In reviewing the proposals, the experts felt that the Work Programme presented in this document would constitute the minimum needed for a critical mass of effort and for attracting the best talents to be associated with the Centre. It was also considered that the techniques that would be developed through the Work Programme could by no means be considered as too advanced or inappropriate for the developing countries, but may

on the other hand form part of a new type of effort by the international community warranted by the urgency of the problems and the inadequacy of present efforts.

III. THRUST OF THE WORK PROGRAMME

12. The Work Programme, which has been designed keeping in mind the considerations mentioned above, has certain broad features which are discussed below. What is presented is not a summary of the proposals but a brief analytical view of the thrust of the Programme.

13. The question of application of genetic engineering and biotechnology to the present problems of developing countries finds reflection in the programme of advanced biotechnology. The approach, however, is different from the conventional approaches. The aim is to create bio-resources development teams at the national level, and link them to national laboratories, the International Centre providing the role of a concept generator and promoter. Some typical areas in which small-scale pilot plant activities may be carried out are also enumerated in the programme but keeping in view that the activities under other programme elements might provide inputs for small-scale pilot plant activities. Consequently, the role of pilot plant activities in the Centre is considered essential and important. The need for addressing the unique problems of developing countries is reflected in other parts of the Work Programme and applicational aspects are stressed, for example in the development of diagnostic kits for human and animal diseases and the development of enzymes of particular value to food processing. The programme for the tertiary recovery of oil from petroleum wells combines both the basic research for construction of strains and the actual field application of such strains.

14. At the same time, some of the components of the programmes envisage activities starting up from basic research. Apart from the fact that in genetic engineering basic and applied research are closely related, the reason for this can be found in answering the question why the initial thrust of commerical application of genetic engineering has been largely directed towards the biomedical field. 7/ It is because of a large data base provided by many years of basic research in a specialized area of microbiology and the general area of biochemical and biomedical sciences. On the other hand, in several other areas, such as energy, food, crop improvements, biological pesticides, etc., critical basic knowledge has to be acquired in a greater measure. This is also the position in regard to tropical diseases, which have not been the subject of adequate commercial interest on the part of established drugs and pharmaceutical companies. Thus, the programme element on biomass addresses itself to the cloning of cellulase genes, that on fertilizers, to alteration of rhizobia, those on human and animal vaccines and tropical diseases to the molecular biology of the relevant micro-organisms and the programme element on agricultural and food products to the basic understanding of the structure of selected plants. However, the diversity of micro-organisms and plant and animal life warrants a selectivity. The need for addressing the pressing problems of developing countries points to the same need. Consequently, research in regard to cellulase genes will have as a goal the possibility of developing a microorganism which could perform the dual function of converting cellulose to sugar and sugar to ethanol. The research in the field of tropical diseases and human and animal vaccines will have as a goal the treatment of selected human and animal diseases, while the programme relating to food and agricultural products will pay special attention to monocotyledons in order to improve important cereals.

7/ See UNIDO/IS.259, page 9

15. Undoubtedly, links and complementarities exist between the activities, e. g. human and animal vaccines and tropical diseases; and fertilizers from biomass and improvement of agricultural products. The programmes on advanced biotechnology and bioinformatics would provide services "across the board". This mix of activities, in essence, provides a unique combination, not available so far, of transdisciplinarity as well as goal orientation, leading to opportunities for cross fertilization and synergy. 8/

16. The combination mentioned above is particularly necessary, since the Work Programme represents an attempt at capacity building in both applied and basic areas, keeping in view certain broad goals of developing countries. While in certain areas the output of research programmes could be some specific strains or new products or processes, in other areas it might be the building up of basic information and of a capacity for research and application which can be put to use in the respective developing countries on the return of the trainees in a manner suited to their own conditions and responding to their own needs.

IV. WORK PROGRAMME IN PERSPECTIVE

17. The Work Programme proposed has to be seen in the perspective of ongoing activities taking place outside the Centre. The Work Programme itself envisages certain field activities and linkages with institutions. These aspects are dealt with in the next section on the implementation of the Work Programme. Here the broader question of external linkages of the Centre will be discussed. The Council of Scientific Advisers is expected to take into account the external linkages in the implementation of the Work Programme.

8/ See also in this connection the diagram showing the transdisciplinarity in UNIDO/IS.254, page 27.

A. Ongoing Research Work

18. The Work Programme envisages expert groups under each programme element in the initial stages so as to take note of ongoing work, if any, in the same fields. However, a verification has also been made with publicly available information on research projects in genetic engineering and biotechnology.[9/] The verification revealed that only in the case of the programme element on agricultural and food products, some universities in the United States have projects related to the proposals in the programme element. The information collected under the bio-informatics programme will, inter alia, help the Centre to maintain a continuous awareness of ongoing work.

19. In general, it should be remembered that the scope of research in this field is vast and the ongoing work, particularly for the benefit of the developing countries limited. It should also be remembered that the orientation of the research programme of the Centre will be towards developing countries, to suit their conditions and requirements. The same may not hold good in respect of other research programmes.

B. Linkages to International Institutions

20. As the expert report on the establishment of the Centre has emphasized, the Centre is visualized as a unique transdisciplinarity unit. During the preparation of the expert report on the establishment of the Centre and subsequently, contacts have been established with important international bodies, such as United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), International Cell Research Organization (ICRO), European Molecular Biology Organization (EMBO), etc. The establishment of the Centre has been brought to the notice of the Advisory Committee on Co-ordination (ACC) Task Force on Science and Technology for Development and the co-operation of interested organizations has been solicited through Technical Working Group I of the ACC Task Force.[10/]

9/ Genetic Engineering/Biotechnology Sourcebook (McGraw-Hill, Washington, D.C., 1982);

10/ This Working Group is entrusted with the subject of early identification and assessment of new scientific and technological developments and global network of scientific and technological information.

21. The Centre provides an integrated instrumentality for the application of genetic engineering to the solution of development problems. The unique advantage of the Work Programme is that solutions will be attempted not only within a transdisciplinarity framework but also in a milieu where expertise in the field of genetic engineering is pooled and the experience of its application in different areas readily available. The Work Programme, through the confluence of such experience, could assist various development programmes through a new class of technologies not hitherto available. The Work Programme in its relevant aspects is expected to liaise with and promote the aims of different important development programmes, such as those undertaken under the auspices of the tropical diseases programme of WHO and Consultative Group on international agricultural research. After the Centre is established, one of its initial tasks will be to propose and develop specific links with international organizations and their ongoing programmes, keeping in view the requirements of its own Work Programme.

C. National Institutions

22. The strengthening of national institutions being the raison d'être of the Centre, links with them are considered vital for an effective Work Programme. The missions undertaken by the experts and the national meetings held have already provided a broad picture of the types of national institutions, with which the Centre could liaise. The linkages could take various forms, both in the creation of national centres and in supporting them. The Centre's training programme is itself designed to train a core group of scientists who would return to their home countries and start project activities in an institutional framework. Advisory services may be provided for the establishment and operation of national centres. National centres of participating countries, whether already established or to be established, could be regarded as associate centres and complementary R+D work could be carried out in them. The Centre may be able to help to improve the R+D work carried out for the national centres or pass on its work at a defined stage for a national centre to adapt it to local conditions. The

national centres may also help, in due course, in the training function of the International Centre. Co-operation with the national centres will surely be necessary in regard to field work. Also, the formation of Biological Resource Development Teams (BIORED) is a unique innovative step whose success would depend on the co-operation and dynamism of national centres.

23. More specific co-operation with national centres would be sought in a number of ways through each aspect of the Work Programme of the Centre, such as R+D, training, advisory services, etc. It is hoped that the participating countries in the Centre would also pay particular attention to such linkages and come up with appropriate proposals.

D. Linkages with Industry

24. Industrial linkages could be envisaged both up-stream and down-stream. The work done in industry could be carried forward for adaptation, on appropriate arrangements being made with industry. Likewise, the research findings of the Centre, which would require commercialization, would involve linkages with industry. The Council of Scientific Advisers would elaborate appropriate detailed guidelines in this respect.

25. Since external interlinkages will substantially contribute to the effectiveness of the Work Programme and also enhance the Work Programme's effectiveness in an international context, it is envisaged that, as a general rule, before the detailed design and implementation of the programme elements of the Work Programme, an expert group meeting will be held for each programme element, which will, inter alia, examine the possible interlinkages between the programme element and ongoing international and national work.

V. IMPLEMENTATION OF THE WORK PROGRAMME

26. While the details of implementation will have to be left to the management of the Centre, a few general observations would be in order at this stage.

27. In the collective review of the proposals, the experts considered carefully whether or not complete specificity in each case should be provided at this stage. They came to the conclusion that such a specificity would not at this stage be possible in all cases and in some cases may not be desirable. The dynamics of research in this field, the need for flexibility in operation, the capacities and aptitudes of the staff and the trainees and the linkages external to the Centre are factors which militate against a detailed and rigid formulation at this stage. Thus each of the proposals in the addenda should be essentially considered as programme elements for budgetary and programme management.

28. The Council of Scientific Advisers of the Centre will have an important role in guiding the implementation of the Work Programme. This Council will, within the framework of the Programme, consider and approve proposals from the Director of the Centre, spelling out each programme element to the level of specificity needed for implementation. It will in the process take into account the level of scientific and technological effort already reached elsewhere and also the linkages that the particular programme element should develop externally for maximizing its effectiveness.

29. As already stated, the convening of expert groups prior to the implementation of each programme element would provide an opportunity for drawing upon high-level experts, both from the problem area addressed (e.g. industry, energy, etc.) and from the several disciplines which will have a bearing on the research programme. The Council of Scientific Advisers may also, if they deem fit, constitute small project review groups to implement specific programme elements.

30. In view of the transdisciplinarity involved, each programme element may have to be implemented by a team consisting of different specializations. The team may also be drawn from more than one department of the Centre. It is considered that the details of the composition of the research teams and departmentwise implementation should be left to the management of the Centre.

31. In formulating the different programme elements, the experts have felt that the composition of the teams should be somewhat different from what was envisaged in the original report on the establishment of the Centre. The manpower requirements were spelled out in that report in terms of scientists and technologists at fairly senior levels. It is now considered that the ICGEB be staffed with more assistant scientists (equivalent of assistant professors) or technologists and fewer senior scientists (equivalent of full professor or advanced associate professor) or technologists. This modification has been suggested, keeping in mind the modalities of organization of research in different laboratories and talking to a number of scientists in Europe and the United States of America. This would enable wider participation in the Work Programme and in particular benefit younger scientists and technologists. This modification does not, however, affect the budgetary implications already worked out, as will be seen from the chapter on the budget.

32. In regard to the teams themselves, in general, for the implementation of each programme element or its component a senior scientist and technologist must have a support team of at least one junior scientist (assistant professor level), two post-doctoral fellows, and one technician; each senior scientist can train two or three trainees.

33. Each programme element involves a range of activities beginning from training and research to advisory missions, expert group meetings, associates, visiting scientists and post-doctoral fellows, etc. This range of activities will broaden the effectiveness of the programme, both by providing to its inputs of excellence and by creating a larger pool of scientists and technologists who could be associated with and possibly benefit from the implementation. The activities under the programme elements have been phased suitably, bearing in mind that the Centre will reach its full level of operation only in its third year.

34. The Work Programme envisages field activities, wherever appropriate, in order to enhance the suitability of the application of research results. However, clinical trials in the field of drugs and pharmaceuticals is not part of the Work Programme at this stage. As indicated in the respective programme elements, the costs of field activities will in principle be borne by the countries where the activities are undertaken or through other funding programmes. They are not part of the financial requirements of the Work Programme, as indicated in the next section.

35. The experts have felt that in regard to the patenting/licensing of any products, processes and know-how developed in the course of the activities under the Work Programme, the policy should be evolved by the management of the Centre after its establishment. Such a policy should, however, be within the framework of the objectives of the Centre and should be designed to promote those objectives. Within this framework preferential access may be considered for participating countries as distinct from other countries. The experts also generally felt that the key to successful administration of a patent and know-how licensing policy would be flexibility to enable the adoption of the most satisfactory licensing or development option presented by the unique facts of each technological development. It would be premature and unrealistic at this stage to take credit in the Work Programme for any income that may accrue to the Centre, particularly bearing in mind the objectives of the Centre and the general orientation of the Work Programme.

VI. FINANCIAL REQUIREMENTS[11/]

36. The proposals made by the experts for the programme elements yielded a level of financial requirements higher than what was envisaged in the report of the establishment of the Centre.[12/] In their collective review the experts agreed on some reductions taking into account the complementarities of the programme elements and the need to keep as far as possible within the limits of the financial requirements originally envisaged. Accordingly, revised financial requirements have been indicated for each programme element in the respective addenda. They have also been incorporated in the document in the budget of the Centre.[13/]

37. The implementation of the Work Programme is feasible within the framework of the resources envisaged in the report on the establishment of the Centre. Consideration of the effective implementation of the Work Programme have, however, necessitated a few modifications and additions, the more important of which are indicated below.

38. The modifications pertain to:

a) the introduction of a revised concept of research teams[14/] with a number of junior scientists (at lesser salary levels), which permits an increase in research personnel to 50 (10 senior scientist and 40 junior scientists) as against the earlier figure of 30 scientists. The number of technicians has been adjusted accordingly from 30 to 40.

b) the provision for 26 post-doctoral fellows who could be associated in the Work Programme.

These modifications have been made without increasing the personnel costs, envisaged in UNIDO/IS.254, through a revised combination of senior and junior personnel.

11/ See also Proposed Budget of the International Centre for Genetic Engineering and Biotechnology

12/ UNIDO/IS.254, pages 23-24

13/ See also Proposed Budget of the International Centre for Genetic Engineering and Biotechnology

14/ See para 31 ante

39. Additions to financial requirements, in the order of US$ 6 million have, however, been necessitated for the following reasons:

a) The number of man-years for training has been increased from 100 to 200, so as to permit 100 trainees to be trained for two years each;

b) In UNIDO/IS.254, laboratory material costs were indicated for only one year. The need for provision for 5 years for a greater number of research workers has increased the financial requirements under this head. However, only moderate norms, adjusted for different types of personnel (e.g. scientist, junior scientist, technician and trainees) have been adopted so as to economize on materials and to keep the operational costs to the minimum.

40. It should be emphasized, that the foregoing modifications and additions would enlarge the number of scientists and technologists participating in and benefitting from the Work Programme and enable more effective implementation of the Work Programme.

41. The resultant financial requirements for each programme element are indicated below:

	Addendum 1		Addendum 2		Addendum 3		Addendum 4		Addendum 5		Addendum 6		TOTAL	
	Quantity	Thousand US$	Quantity	Thousand US$	Quantity	Thousand US$	Quantity	Thousand US$	Quantity	Thousand US$	Quantity	Thousand US$	Quantity	Thousand US$
Staff Requirements														
Management of the Centre		233.5		233.5		122.5		233.5		142		50		1,015
Scientific and Technological Staff:														
- Senior Scientist	8m/y	600	8m/y	600	8m/y	600	8m/y	600	4m/y	300	4m/y	300	40m/y	3,000
- Junior Scientist	32m/y	1,440	32m/y	1,440	16m/y	720	40m/y	1,800	32m/y	1,440	8m/y	360	160m/y	7,200
- Post-Doctoral Fellow	28m/y	672	28m/y	672	12m/y	288	24m/y	576	12m/y	288	-	-	104m/y	2,496
- Technicians	48m/y	816	32m/y	544	16m/y	272	32m/y	544	24m/y	408	8m/y	136	160m/y	2,720
Supporting Personnel		703.5		703.5		366.5		703.5		428		155		3,060
Subtotal		4,465.0		4,193.0		2,369.0		4,457.0		3,006		1,001		19,491
Visiting Scientists	60m/m	480	40m/m	320	20m/m	160	40m/m	320	40m/m	320	-	-	200m/m	1,600
Expert Group Meeting	4	100	4	100	2	50	4	100	4	100	2	50	20	500
Advisory Services	45m/m	450	30m/m	300	15m/m	150	30m/m	300	30m/m	300	-	-	155m/m	1,500
Training	40m/y	900	50m/y	1,125	30m/y	675	40m/y	900	40m/y	900	-	-	200m/y	4,500
Purchase of Chemicals, etc.		1,620		1,040		560		1,040		760				5,020
Information Material		45		30		15		30		30		600		750
Associateship		150		150		75		150		150		75		750
Miscellaneous (travel, telephone, postage, etc.)		138		138		72		138		84		30		600
		8,348.0		7,396.0		4,126.0		7,435.0		5,650		1,756		34,711

m/y = man year
m/m = man month

Addendum 1 - Selective Application of Advanced Biotechnology for Developing Countries
Addendum 2 - Application of Genetic Engineering for Energy and Fertilizer Production from Biomass
Addendum 3 - Hydrocarbon Microbiology with Special Reference to Tertiary Oil Recovery from Petroleum Wells
Addendum 4 - Application of Genetic Engineering and Biotechnology for the Production of Improved Human and Animal Vaccines with Particular Reference to Tropical Diseases
Addendum 5 - Improved Agricultural and Food Products through Genetic Engineering and Biotechnology
Addendum 6 - Bio-informatics

42. The addenda in the programme elements also contain details of the equipment needed for each of them. Since many items of equipment can be shared for several activities, these requirements would be met from the common equipment, listed in UNIDO/IS.254, page 23.

43. It is, however, important to note that the sum total of the work of the Centre would in a sense be more than that of the sum of its programme elements, both on account of synergy and cross fertilization and also on account of the fact that scientists usually carry on a certain amount of basic research irrespective of the implementation of specific research projects.

VII. ACTION REQUIRED

44. The meeting is requested to consider the Work Programme and, in order that it may constitute the basis for the budget of the Centre and for contributions from participating governments and other sources,

a) agree to generally, endorse the Work Programme for the purposes mentioned above; and

b) recommend it to the ministerial-level meeting for its approval.